Incentivizing knowledge exchange engagement: direct and indirect benefits of external engagement

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Abstract

Engagement in knowledge exchange (KE) with external actors has become widely accepted as an integral mission of universities. However, research and teaching performance remain more important for career progression, while engagement activities are more weakly institutionalized. This raises the question of why academics participate in knowledge exchange engagement activities. This paper examines to what extent academics perceive that they are rewarded directly for KE by their university and to what extent they perceive to benefit in terms of their performance in other missions (research and teaching). Furthermore, we examine how these perceptions are associated with actual engagement behavior. We use data from a sample of academics in seven European universities to examine whether direct and indirect benefits from engagement are linked to engagement in a broad range of KE activities. The results suggest that direct university rewards are associated with less engagement in KE activities, while perceived indirect benefits are associated with more engagement. These relationships are particularly strong in STEM fields.

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Introduction

Universities have adopted different strategies to align third mission activities with teaching and research roles, including the use of incentives and rewards to develop their KE engagement profiles (van de Burgwal, Dias, & Claassen, 2019). However, third mission activities still often carry little weight in recruitment and promotion decisions. Furthermore, academics rarely have dedicated time allocated to KE activities (Hayden, Weiß, Pechriggl, & Wutti, 2018).

The relationship between teaching, research and KE engagement has been investigated quite extensively in the literature. Such studies have examined the perceived compatibility between these roles, discussed whether they can be performed simultaneously, and identified their drivers. Some have investigated the association among research, teaching and KE engagement and found varying results (e.g., Reymert & Thune, 2022; Sánchez-Barrioluengo, 2014; Wang, Hu, Li, & Pan, 2016). Others have explored the effect of incentives and rewards on academics' KE engagement, but mainly for formal engagement activities that deliver economic outcomes (e.g., Arqué-Castells, Cartaxo, García-Quevedo, & Godinho, 2016; Baldini, 2010). Furthermore, the findings have been inconsistent across different studies (e.g., Barjak, Es-Sadki, & Arundel, 2015; Markman, Gianiodis, Phan, & Balkin, 2004).

Academics derive tangible and intangible benefits from external engagement for research and teaching (D'Este & Perkmann, 2011). However, it is unclear whether the perceived benefits from KE engagement and rewards have any bearing on actual engagement behavior. Moreover, existing studies on KE engagement tend to perform their analyses at the university level (e.g., Sánchez-Barrioluengo, 2014) and in single country contexts (e.g., Reymert & Thune, 2022; Wang, Hu, Li, & Pan, 2016). Furthermore, there are vast differences in the mix of activities that academics engage in across disciplines. Those in the sciences, technology, engineering and mathematics (STEM) fields are more likely to engage in research-related and commercialization activities, while those in the social sciences and humanities (SSH) tend to focus on teaching and advisory activities (Hewitt-Dundas, 2012). We do not know whether STEM and SSH scholars perceive the benefits from engagement differently or respond to KE engagement rewards differently. The study addresses these gaps by drawing on individual academics' perspectives, using data from universities several European countries.

This paper provides empirical evidence on the influence of different benefits on academics' KE engagement. We answer the following related research questions: To what extent are academics' perceptions of benefits from knowledge exchange engagement associated with their

actual engagement? And to what extent do these associations differ between scientific fields? We use data from a sample of 625 academics from seven universities that participated in the RUNIN-ECIU Academics' Survey. The results show significant variations in the perception of benefits, as well as in the association between these benefits and KE engagement behavior. Surprisingly, direct benefits tend to diminish engagement in a broad range of activities, while perceived indirect benefits increase engagement. These relationships are stronger for STEM than for SSH scholars.

Literature review

The third mission of universities

Universities have always had several missions, with a common theme being the provision of services to society. These include teaching, research, and various other academic services to changing stakeholders within their communities and beyond (Scott, 2006). Today, there is policy pressure on universities to broaden their societal engagement remit. Often conceived as the third mission, universities are expected to generate and exploit knowledge to contribute to innovation-led growth of places (Laredo, 2007). This has resulted in legislation and policies to persuade universities to intensify third mission efforts (Kitagawa & Lightowler, 2013; Rosli & Rossi, 2016).

Accordingly, the third mission has been formally integrated into the core activities of most universities, albeit to a varying extent. This is evident in the inclusion of third mission activities in internal policies and strategic plans (Pinheiro, Langa, & Pausits, 2015). For instance, faculty are increasingly required to report their third mission activities in addition to research and teaching performance metrics (van de Burgwal et al., 2019). Additionally, universities have establish structures like technology transfer offices and community liaison offices to support academics performing third mission functions.

Whereas universities are increasingly embracing the third mission, its integration into promotion and recruitment systems remains undeveloped in most universities. Most often, a set format for measuring and evaluating KE engagement are non-existent (Smith, Else & Crookes, 2014). Performance in research remains most important for recruitment and promotion, while teaching structure how most academics spend their time (Hayden et al., 2018). The relatively lower importance of KE engagement in career advancement of academics raises the question

of what academics get out of performing KE activities. How do they perceive to benefit from such activities?

Benefits from knowledge exchange activities

There is growing evidence that engagement in third mission activities reinforces the development of teaching and research (Reymert & Thune, 2022; Wang et al., 2016). The knowledge exchanges produce positive spillovers for research and teaching in terms of knowledge and other resource acquisitions, which in turn stimulate more engagement, thus forming a virtuous cycle of engagement. It can therefore be argued that academics need not be rewarded for performing these activities as the benefits are in themselves incentives (we discuss this in the next section). However, engaging in knowledge exchange activities involves "opportunity cost for time they cannot spend on [teaching and research] activities that currently primarily determine their career progression" (van de Burgwal et al., 2019, p. 14). To ameliorate this problem, universities may incentivize academics directly to engage in these activities (Fehr & Schmidt, 2004). Many universities have implemented incentive or reward schemes to encourage the performance of at least some types of knowledge exchange activities (van de Burgwal et al., 2019).

The scope of KE activities ranges from formal activities (e.g., patenting and launching spin-offs) to informal ones like ad-hoc advice, employee training and student internships (D'Este & Patel, 2007; Miller, Alexander, Cunningham, & Albats, 2018). Engagement in formal activities is relatively rare and mainly occurs in some (typically STEM) disciplines, while a much larger share of academics engage in informal activities (D'Este & Patel, 2007). Engagement in formal activities is often rewarded with financial incentives like revenue sharing, equity or royalty sharing (van de Burgwal et al., 2019), partly because engagement in these activities results in tangible economic outcomes that can easily be quantified. However, academics are often more motivated by furthering their research and promoting its application in society, and monetary incentives may crowd out such intrinsic motivations (Atta-Owusu & Fitjar, 2022; Bregn, 2013).

Although less formal or informal KE activities contribute to broader societal impact, there are fewer incentives for these activities in most universities. Whereas engagement in these activities is sometimes rewarded with discretionary incentives such as awards and prizes (van de Burgwal et al., 2019), they do not lend themselves to easy objective evaluation, making it difficult to provide financial incentives (Bregn, 2013; Prendergast, 1999). However, discretionary incentives can also be desirable and effective in stimulating academics' KE engagement (van

de Burgwal et al., 2019; Frey & Neckermann, 2008; Neckermann & Frey, 2013). For instance, Neckermann and Frey (2013) show that introducing a hypothetical award increased the stated willingness of employees to exchange information.

Indirect benefits from knowledge exchange activities

Besides these direct benefits, engagement can result in several indirect benefits, insofar as it can contribute to the improvement of teaching and/or research. These include reputational, relational, intellectual, material and economic benefits (Arza, 2010; Garcia, Araújo, Mascarini, Santos, & Costa, 2019; Lam, 2011). Reputational benefit is an important intangible reward or payoff received from engagement partners. Working with external actors can build one's reputation among different actors. This enhanced reputation can signal expertise, thereby leading to other rewards and potential collaboration (Lam, 2011). Academics also benefit from the relationships they develop engaging with non-academic actors. In addition, academics forge social ties and friendships that can be beneficial in future engagements (Nahapiet & Ghoshal, 1998; Thune, 2007). For instance, an academic may rely on an industry partner they collaborate with as a guest lecturer for a course, or as a project partner in a funding proposal.

Furthermore, knowledge exchange between academics and societal partners goes both ways. Hence, academics also learn and acquire new knowledge from engaging with external actors (Hemmert, 2017; Garcia et al., 2019). Engagement may provide inspiration for novel research ideas or funding proposals that are helpful for their career advancement (Garcia et al., 2019). It may also lead to improvements in teaching, enriching the course content and enhancing the learning experience of students (Wang et al., 2016). It could result in developing innovative products or technologies for commercial or social application (Hemmert, 2017).

Beside the intangible benefits, academics can also receive tangible material and economic benefits, such as non-monetary resources to advance their research and teaching roles. These include data, specialist equipment or facilities and new research projects (Arza, 2010; D'Este & Perkmann, 2011). Moreover, external engagement might provide opportunities for academics to secure joint projects and internships for their students (Wang et al., 2016).

Taken together, academics acquire various benefits in their KE engagement, which impact positively on their teaching and research roles. Given that satisfactory performance in these roles is the primary determinant of career advancement, we expect academics to participate

more in KE engagement, if they perceive to benefit in terms of their research and teaching activities. The theoretical framework proposed in this study is depicted in Figure 1.

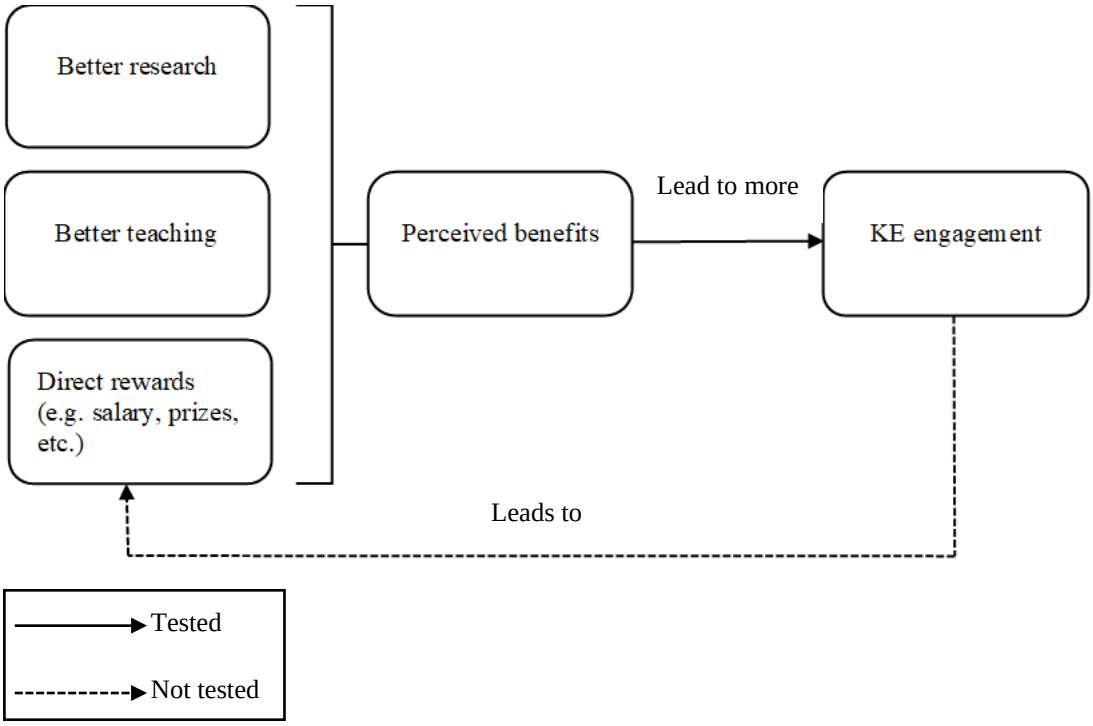

Figure 1. Theoretical framework

Methodology

Data

We use data from the RUNIN-ECIU Academics' Survey, which was conducted in autumn 2019 as part of a research project on the role of universities in innovation and regional development. The study sample is drawn from ECIU-member universities. These institutions are Aalborg University, Autonomous University of Barcelona, Dublin City University, Kaunas University

of Technology, University of Stavanger, University of Trento and University of Twente. It targeted academics in all scientific disciplines, from research fellows to full professors, in teaching and/or research positions. The survey was distributed via e-mail from local university contacts to 7,330 academics, using university mailing lists. In total, we collected 635 responses, corresponding to a response rate of 8.7%. After removing responses by ineligible respondents (e.g. PhD candidates), a final sample of 625 remained for analysis.

We perform a set of non-response analyses: First, we compare early and late respondents (Armstrong & Overton, 1977). The results largely show insignificant differences between these groups when controlling for academics' gender, age, professional experience, discipline, and research orientation. We also compare the sample to the whole population of academics at the selected universities on background variables. There are some differences between the sample and population distribution. We observe that SSH fields, female academics and full professors are overrepresented. The response rate also differs across universities. We assess whether non-response bias in these dimensions affect the results by including post-stratification weights to correct for differences between the sample and the population in these dimensions in a robustness test. The weighted results are robust when compared to the main unweighted estimates, except for indirect benefits from teaching, which is not significant in the weighted model. The results are presented in Table A3 in the supplemental materials online.

Variables

The main dependent variable of interest captures the extent to which academics engage with non-academic actors. *KE engagement breadth* measures the number of different engagement activities academics have engaged in within a three-year window. We construct this measure following the approach of D'Este and Patel (2007). Respondents were asked whether they engaged in any of nine activities with external partners in the past three years (2016-2019). These items are binary, taking the value 1 if an academic engaged in an activity and 0 otherwise. We subsequently create a summative measure with a value of 0 if a respondent reports not engaging in any of the nine activities and a maximum value of 9 if they engaged in all activities. The variable has a Cronbach's alpha of 0.76, indicating a high internal consistency. See Table A1 in the supplemental material for the list of activities and their frequency.

The main explanatory variables are perceived direct and indirect benefits from engagement. The indirect benefits variables measure the *research* and *teaching* benefits academics derive from KE engagement. The two variables are created based on a question that asked respondents

to rate the extent to which they agree or disagree with statements on the impact their engagement has had on their research and teaching, respectively. Respondents answered the questions using a 5-point scale (1 = strongly disagree; 5 = strongly agree).

The perceived engagement benefit on research variable was constructed with four items covering effects on research projects, reputation, insights and networks. Four items were also used to construct the perceived engagement benefit on teaching variable, covering effects on teaching content and delivery, and on students' employability or entrepreneurial skills.. We summed the score of the four items to create the two variables. A score below the mean indicates a perception of low benefits from engagement, whereas a score above the mean suggests high benefits. Both variables have high internal consistency, with Cronbach's alpha coefficients of 0.83 and 0.84, respectively. All the items are presented in Tables A6 and A7.

The perceived direct benefit from engagement measures the extent to which academics feel they are adequately rewarded for KE engagement. The single item variable is taken from a question that asked respondents to indicate their level of agreement with statements concerning their universities' support for external engagement. The statement was 'my university rewards me for working with external partners' and was rated on a 5-point scale (1 = strongly disagree; 5 = strongly agree). For all questions, we replaced responses of 'don't know' and missing values with an item mean before creating the indices. See Table A6 to A8 for the percentages of responses to each item.

We include dummies for being female, age below 40, age 40-49, professional experience, working in STEM fields, and for the seven universities, as well as for self-reported research orientation (basic research, user-inspired basic research, applied research, and other).

Estimation strategy

To investigate the effects of perceived direct and indirect benefits from engagement on academics' KE engagement, we estimate a regression using KE engagement breadth as the outcome variable. As this variable is a count, we estimate the empirical model with Poisson regressions using the quasi-maximum likelihood estimation method.

We conduct further analyses to test whether the effects of the explanatory variables differ between STEM and SSH academics by adding interactions between perceived benefits from engagement and academic field. Specifically, we estimate three additional models in which we interact each of the three independent variables with the dummy variable for STEM fields, one

by one. We further test the robustness of the results by replacing the dependent variable with KE engagement depth (Table A4), and by estimating the models with ordered logistic regression (Table A5). The results remain consistent with the main results, except that benefits from teaching does not have a significant effect on engagement depth.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
KE engagement breadth	625	3.05	2.34	0	9
Indirect_benefit_research	625	4.184	.779	1	5
Indirect_benefit_teaching	625	3.164	.925	1	5
Direct benefit	625	3.178	1.144	1	5
Female	625	.442	.497	0	1
Age < 40	625	.213	.41	0	1
Age 40-49	625	.307	.462	0	1
Age ≥ 50	625	.48	.5	0	1
Professional experience	625	.598	.491	0	1
Basic research	625	.194	.395	0	1
User-inspired basic research	625	.286	.452	0	1
Applied research	625	.475	.5	0	1
Other	625	.045	.207	0	1
STEM fields	625	.461	.499	0	1

Results

Table 1 presents the descriptive statistics for all the variables, while the correlations between the variables are reported in Table A1. Apart from a few correlations above 0.50, all the rest are generally low to moderate. Hence, multicollinearity is not a problem.

The distribution of the use of the engagement activities by academics in the sample is reported in Table A2. Informal advice and collaborative research are the most used channels for KE engagement. Sixty-two percent and 59% of academics engage in these activities, respectively. Over a third of academics engage through student projects and internships, and contract research, while close to 30% engage in supervision of students with external partners and providing consulting services. Around a quarter of academics organize training for employees or serve on advisory boards of external organizations. Research commercialization is the least used channel, with only six percent of respondents reporting this mode of engagement. Overall, these findings suggest that academics engage with external actors through a mix of formal and informal activities. However, informal engagement activities are more common than formal ones, such as patenting (D'Este & Patel, 2007).

Figures A1 and A2 show the distribution of perceived benefits from KE engagement on the research and teaching activities of academics. A significant proportion of academics report that engaging in KE activities has been beneficial to their research. About 85% of academics agree or strongly agree that KE engagement helped them acquire new ideas and contacts. Seventy-seven percent indicated it has helped them secure new research projects, whereas 75% said it has enhanced their reputation in a scientific field.

On the benefits of KE engagement to teaching, close to 55% of academics agree or strongly agree that it has resulted in changes to courses and the delivery of course content. Just over 40% indicated participation in KE engagement has enhanced their students' employability prospects, while 29% believe it has impacted the entrepreneurial skills of their students. Overall, the findings suggest that KE engagement provide more benefits for academics' research than teaching functions (Sánchez-Barrioluengo, 2014). Moreover, impacts on academics' own teaching is more common than direct impacts on student outcomes.

Only a relatively small number of respondents affirmed receiving some form of reward from their university (Figure A3). Just 23% of respondents agreed or strongly agreed with the statement, while 48% disagreed or strongly disagreed. Most academics in the sample do not think engaging with external partners features prominently in their universities' reward schemes despite the existence of several incentive schemes for KE engagement at most European universities (van de Burgwal et al., 2019).

The regression analyses demonstrate the extent to which the perceptions of benefit are associated with actual engagement behavior. Table 2 presents the main results of a set of Poisson models examining the relationship between academics' perceived direct and indirect benefits from engagement and the breadth of their KE engagement. Model 1 is the baseline containing only the control variables. Age below 40 has a negative effect on engagement. Consistent with prior studies, academics with work experience in other sectors prior to joining academia tend to engage more with external partners (Gulbrandsen & Thune, 2017). Academics who consider their research to be user-inspired, applied or other also tend to engage more than those with basic research orientation. This is in line with prior studies (e.g., Freel, Persaud, & Chamberlin, 2019). Finally, there is no significant difference between STEM and SSH fields, or between male and female researchers.

In Model 2, both the perceived indirect benefits from engagement variables have positive and significant associations with KE engagement breadth. Academics who think that engaging with

external partners brings benefits for their research, tend to engage in more KE activities. In the same vein, perceived engagement benefits for teaching are related with increased KE engagement, albeit with a smaller increase in engagement activities compared to perceived benefits for research. A 1-standard-deviation (SD) change in benefits for teaching is associated with 7% increase in engagement breadth while a 1-SD change in benefits for research leads to 24% rise in expected engagement activities. However, direct benefits have a negative and significant relationship with KE engagement. Paradoxically, this suggests that academics who perceive to be rewarded more for engaging with external partners tend to engage less. In percentage terms, a 1-SD increase in university rewards reduces the expected number of activities academics engage in by 5%. All the control variables have the same effect as in the baseline model, except that the female dummy becomes significant.

In the remaining models (3-5), we include interaction terms between the benefits of engagement and disciplinary fields. In Model 3, the interaction between engagement benefits for research and STEM is positive and significant. The interaction effects of benefits for teaching and STEM (Model 4) and for direct benefits and STEM (Model 5) are not significant.

We further calculate the marginal effects of the interacted variables for STEM and SSH disciplines (Kingsley, Noordewier and Bergh 2017). Table 3 reports these effects. We observe positive and significant marginal effects of engagement benefits for research in both STEM and SSH disciplines. Hence, perceived benefits for research are significantly related to engagement behavior for both STEM and SSH scholars. However, the strength of the relationship is much higher in STEM fields, with the coefficient being more than three times larger. The marginal effect of engagement benefit for teaching is positive but insignificant for academics in SSH fields. For academics in STEM, the effect is positive and significant. Hence, perceived benefits for teaching are only relevant for the engagement behavior of STEM scholars. Lastly, we find that the marginal effect of direct benefits is negative and insignificant for SSH academics, whereas it is negative and significant for those in STEM. Thus, we only find a negative relationship between direct benefits and engagement behavior for STEM scholars.

Table 2. Poisson regression results of the main estimation model

Outcome variable:	KE engagement breadth				
	Baseline model	Full model	Full model with interaction terms		
	(1)	(2)	(3)	(4)	(5)
Variables					
Indirect_benefit_research		0.292***	0.139*	0.291***	0.291***
		(0.056)	(0.067)	(0.056)	(0.055)
Indirect_benefit_teaching		0.079*	0.072*	0.026	0.081*
		(0.032)	(0.031)	(0.042)	(0.032)
Direct benefit		-0.048*	-0.046*	-0.049*	-0.027
		(0.021)	(0.021)	(0.021)	(0.031)
Female	-0.102	-0.115*	-0.111*	-0.123*	-0.113*
	(0.060)	(0.057)	(0.056)	(0.057)	(0.057)
Age (Ref: Age ≥ 50)					
Age < 40	-0.386***	-0.316***	-0.328***	-0.324***	-0.311***
	(0.091)	(0.086)	(0.086)	(0.086)	(0.086)
Age 40-49	0.051	0.047	0.048	0.052	0.046
	(0.061)	(0.059)	(0.059)	(0.059)	(0.059)
Professional experience	0.189**	0.163**	0.165**	0.163**	0.164**
	(0.062)	(0.059)	(0.058)	(0.059)	(0.059)
Research orientation (Ref: Basic research)					
User-inspired basic res.	0.671***	0.566***	0.585***	0.574***	0.560***
	(0.135)	(0.135)	(0.135)	(0.134)	(0.136)
Applied research	0.798***	0.665***	0.686***	0.679***	0.658***
	(0.128)	(0.130)	(0.130)	(0.129)	(0.130)
Other	0.619***	0.507*	0.501*	0.517*	0.500*
	(0.206)	(0.202)	(0.199)	(0.202)	(0.202)
STEM fields	0.044	0.052	-1.426***	-0.279	0.188
	(0.058)	(0.054)	(0.403)	(0.207)	(0.142)
STEM × Indirect_benefit_res			0.337***		
			(0.089)		
STEM × Indirect_benefit_tea				0.099	
				(0.058)	
STEM × Direct benefit					-0.043
					(0.042)
University dummies	Yes	Yes	Yes	Yes	Yes
Constant	0.483***	-0.768**	-0.121	-0.591*	-0.828**
	(0.139)	(0.263)	(0.302)	(0.279)	(0.266)
Log likelihood	-1351	-1305	-1294	-1303	-1305
Pseudo R^2	0.0813	0.113	0.120	0.114	0.113
Observations	625	625	625	625	625

Note: Robust standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Table 3. Marginal effects of explanatory variables for SSH and STEM fields

	Indirect benefit for research	Indirect benefit for teaching	Direct benefit
SSH	0.411*	0.078	-0.080
	(0.197)	(0.119)	(0.092)
STEM	1.482***	0.392**	-0.218*
	(0.200)	(0.140)	(0.090)

Note: Robust standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Discussion and Conclusions

This study contributes to the debate on the effectiveness and limitations of incentives in the KE engagement of academics. Relying on a sample of academics in seven European universities, we examine their perceptions of direct and indirect benefits from engagement and its association with actual KE engagement behavior. We also investigate the differential effect of these perceptions across broad scientific fields.

We find that academics perceive to benefit from external engagement mainly in terms of improvement of their research. This perception is also the most closely linked to actual engagement behavior. A stronger perception of benefits for research is associated with an increase in the breadth of activities academics engage in. In other words, academics' belief that engagement impacts their research role positively is linked to the scope of activities they tend to engage in. This is consistent with earlier studies that demonstrate that KE engagement complements the research role rather than conflicting with it (Sánchez-Barrioluengo, 2014; Wang et al., 2016). Conducting impactful research remains an important route to achieving peer recognition and career advancement in academia. However, achieving this requires marshaling resources from diverse sources, for which knowledge engagement activities may be helpful.

Second, many academics perceive to benefit from external engagement in their teaching, and this perception is also associated with actual engagement behavior. However, this effect is weaker than the perceived impact of engagement on research.

Third, few academics perceive to be rewarded by the university for KE engagement. Furthermore, and somewhat paradoxically, those who do perceive to benefit directly actually engage less. This result is contradictory to a notion in the principal-agent theory that holds that providing incentives results in increased effort of agents (Holmstrom & Milgrom, 1991; Prendergast, 1999). However, incentives and rewards schemes may crowd out more intrinsic motivations for engagement (Bregn, 2013). Academics who engage a lot may also think that they are not rewarded enough for this contribution and may therefore provide more negative responses than those who engage to a lesser extent.

Another important contribution is the demonstration of field differences in the effect of different forms of incentives on engagement behavior of academics. The study shows that the perception of benefits is more closely associated with KE engagement of academics in STEM fields than in SSH fields. These differences could be attributable to differences in research across these fields and in the forms of interactions with external actors (Bonaccorsi, et al., 2021; Olmos-

Peñuela, et al., 2014). Further research is required to unpack the reasons underlying these differences across fields.

The negative association between direct benefits and engagement is also specific to STEM fields. Perceiving to benefit directly from engagement is associated with a reduction in the engagement activities in STEM, while it has no effect in SSH. The negative effect is specific to very informal engagement activities such as informal advice and employee training, which can be hard to observe and are rarely rewarded. Hence, a plausible explanation is that academics who perceive to benefit from engagement reduce their participation in engagement activities which are unlikely to yield any benefits. Since STEM scholars engage more frequently than SSH scholars in more formal engagement activities, this pattern could be more pronounced in STEM fields.

This study has implications for how universities and academics should think about KE engagement activities and the policies to promote them. The findings indicate that many academics experience benefits for their research and teaching from engagement activities. Furthermore, they tend to engage more when they experience the various missions as mutually reinforcing, rather than as separate activities competing for their time. Hence, universities should avoid knowledge engagement becoming an additional obligation apart from teaching and research, but rather strengthen the connection with other activities. Academics can more readily prioritize engagement activities which are research-based and/or student-oriented, and equally their research and teaching can be inspired by external engagement. Recent trends towards greater emphasis on impact in research assessment and the growing use of challenge-based learning are examples of how to build these types of links. The synergies are more important than the existence of direct rewards for engagement, which can even crowd out informal engagement activities that are hard to observe and reward.

Despite shedding new light on the effectiveness of direct and indirect incentives for KE engagement, this study is subject to some limitations. We measured direct benefits subjectively from the opinion of academics. While we invested efforts to minimize social desirability bias by separating this question from the dependent variable, there is still a risk of socially desirable responses biasing the results. Caution should therefore be exercised in interpreting the findings. Relatedly, we used a single item to measure indirect benefits and may be subject to measurement error. A recent study by van de Burgwal et al. (2019) identified different types of incentives for engagement. However, this was published after we conducted the survey, and we could therefore not include these measures. Therefore, we were unable to examine whether

different incentives exert differing effects on KE engagement. Future surveys on engagement incentives could draw on this study to capture broad incentives for empirical analysis.

Another limitation arises from the nature of the institutions selected for the study. The study is limited to a relatively small number of entrepreneurial universities who place premium on third mission activities. This may have introduced some sorting problems notwithstanding the measures adopted to prevent this biasing the results. Hence, we do not know to what extent these results are influenced by this characteristic and the extent this can be generalized to less-entrepreneurial universities. Future studies might consider using large-scale survey design targeting different types of universities.

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